

Patent claims

a 1. A vector, for inserting a nucleic acid into a cell, which vector ^{comprises} ~~contains~~ a low molecular weight polyethylenimine (LMW PEI) and a nucleic acid, ^{wherein} ~~with~~ the LMW PEI having a molecular weight of less than 50,000 Da.

a 2. *The* ~~A~~ vector as claimed in claim 1, wherein the LMW PEI has a molecular weight of from 500 to 30,000 Da.

a 3. *The* ~~A~~ vector as claimed in ~~either of claims 1 and 2~~, wherein the LMW PEI has a molecular weight of from 1000 to 5000 Da.

a 4. *The* ~~A~~ vector as claimed in ~~one or more of claims 1 to 3~~, wherein the LMW PEI has a molecular weight of about 2000 Da.

a 5. *The* ~~A~~ vector as claimed in ~~one or more of claims 1 to 4~~, wherein the nucleic acid is a viral or nonviral nucleic acid construct.

a 6. *The* ~~A~~ vector as claimed in ~~one or more of claims 1 to 5~~, wherein the nucleic acid construct contains one or more effector genes.

a 7. *The* ~~A~~ vector as claimed in ~~one or more of claims 1 to 6~~, wherein at least one effector gene encodes a pharmacologically active compound or its prodrug form.

a 8. *The* ~~A~~ vector as claimed in ~~one or more of claims 1 to 7~~, wherein at least one effector gene encodes an enzyme.

a 9. *The* ~~A~~ vector as claimed in ~~one or more of claims 1 to 8~~, wherein at least one effector gene is expressed together with a cell-specific ligand as a fusion protein.

a 10. *The* ~~A~~ vector as claimed in ~~one or more of claims 1 to 9~~, wherein the LMW PEI is coupled to a cell-specific ligand.

a 11. *The* ~~A~~ vector as claimed in ~~one or more of claims 1 to 10~~, wherein the cell-specific ligand binds to the outer membrane of a target cell.

a aa 12. ~~The~~ ²¹ *A* vector as claimed in ~~one or more of claims 1 to 11~~, wherein the target cell is an endothelial cell, a muscle cell, a macrophage, a lymphocyte, a glia cell, an hematopoietic cell, a tumor cell, a virus-infected cell, a bronchial epithelial cell or a liver cell.

a aa 5 ¹⁰³ 13. ~~The~~ ^{claim 1} *A* vector as claimed in ~~one or more of claims 1 to 12~~, wherein the ratio by weight of LMW PEI to nucleic acid is 3:1 or more.

a aa 14. ¹⁰ ~~The~~ ^{claim 1} *A* vector as claimed in ~~one or more of claims 1 to 13~~, wherein the ratio by weight of LMW PEI to nucleic acid is 8:1 or more.

Sub A 15. ~~A process for preparing a low molecular weight polyethylenimine (LMW PEI) having a molecular weight of less than 50,000 Da, which comprises monomeric ethylenimine being polymerized in aqueous solution by adding hydrochloric acid.~~

aa 16. ²⁰ The process as claimed in claim 15, wherein the aqueous solution is from 0.1% strength to 90% strength with respect to monomeric ethylenimine and from 0.1% strength to 10% strength with respect to concentrated hydrochloric acid.

aa 17. ²⁵ The process as claimed in ~~either of claims 15 and 16~~, wherein the polymerization is carried out at a reaction temperature of from 30°C to 70°C.

aa 18. ³⁰ The process as claimed in ~~one or more of claims 15 to 17~~, wherein the reaction time is from 1 to 30 days.

aa 19. A low molecular weight polyethylenimine which has a molecular weight of less than 50,000 Da and which is prepared by a process according to ~~one or more of claims 15 to 18~~.

aa 20. ³⁵ The use of a low molecular weight polyethylenimine having a molecular weight of less than 50,000 Da for preparing a vector as claimed in one or more of claims 1 to 14.

aa 21. ¹⁰² *A process for preparing a vector according to ~~one or more of claims 1 to 14~~, which comprises mixing an appropriate quantity of*

LMW PEI with an appropriate quantity of nucleic acid in an aqueous solution.

- Sub A 5 22. The use of a vector as claimed in one or more of claims 1 to 14 for inserting a nucleic acid into a cell.
- Sub A 10 23. The use of a vector as claimed in claim 22, wherein the cell is an endothelial cell, a lymphocyte, a macrophage, a liver cell, a fibroblast, a muscle cell or an epithelial cell.
- Sub A 102 24. A process for preparing a transfected cell, which comprises incubating a vector as claimed in ~~one or more of claims 1 to 14~~ in vitro with ~~this~~ cell.
- Sub A 15 25. A transfected cell which contains a vector as claimed in ~~one or more of claims 1 to 14~~. *claim 1*
- Sub A 20 26. The use of a transfected cell as claimed in claim 25 for preparing a pharmaceutical.
- Sub A 25 27. The use of a low molecular weight polyethylenimine as claimed in claim 19 for preparing a pharmaceutical.
- Sub A 30 28. The use of a vector as claimed in one or more of claims 1 to 14 for preparing a pharmaceutical.
- Sub A 35 29. The use of a vector as claimed in one or more of claims 1 to 14 for preparing a pharmaceutical for gene therapy.
- Sub A 30 30. A process for preparing a pharmaceutical, which comprises mixing a nucleic acid with an LMW PEI.
- Sub A 35 31. A pharmaceutical which comprises a vector as claimed in ~~one or more of claims 1 to 14~~. *claim 1*
- Sub A 35 32. A pharmaceutical which comprises an LMW PEI as claimed in claim 19.

33. A pharmaceutical which comprises a transfected cell as claimed in claim 25.

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